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THE IDENTITY OF LYCOPODIUM POROPHILUM

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IN an attempt to understand the Wisconsin material of *Lycopodium porophyllum* Lloyd & Underwood (*L. lucidulum*, var. *porophyllum* (L. & U.) Clute) it has become evident that this form has been misinterpreted, and as treated in Gray's Manual and in other manuals contains two elements. These two elements are *L. Selago*, var. *patens* (Beauv.) Desv. and *L. lucidulum*, forma *occidentale* Clute.

The spores of the various North American Lycopods have been studied (paper now in press) and differences were found between those of *L. Selago* and *L. lucidulum*. The spores of true *L. porophyllum* have a distinct *L. Selago* pattern, which suggests relationship between these two forms, since all other distinct species examined have characteristic spores.

Herbarium specimens from various parts of North America and Europe were next consulted and found to be confusing until a series of *L. Selago* specimens was constructed to show gradation from the appressed leaves of the variety *appressum* to the less appressed leaves of the type and the wide-spreading aspect of the variety *patens*. Comparison of a fragment of the type specimen of *L. porophyllum* with *L. Selago*, var. *patens* shows these two forms to be identical.

During the investigation specimens from New England which had been identified as *L. lucidulum*, var. *porophyllum* were obtained from the Gray Herbarium. Examination of the specimens proved them to be a rather distinct form of *L. lucidulum*, the second element confused with the so-called *L. porophyllum*. Further comparison with western material has shown these specimens to correspond to *L. lucidulum*, forma *occidentale* Clute. Other specimens of this form have been examined from Minnesota, Wisconsin and Indiana.

The habitats of the eastern and middle western specimens were sub-alpine or northern. Those of the west were from the bases of the mountains and in the highlands; these habitats appear to correspond with the approximate altitude and ecology of the more eastern stations. In as much as typical *L. lucidulum* is not reported from the western United States it seems justifiable to treat Clute's forma *occidentale* as a variety with definite habitat and range.

LYCOPodium LUCIDULUM, var. **occidentale** (Clute), n. comb. *L. lucidulum*, forma *occidentale* Clute, Fern. Bull. **11**: 13. 1903. *L. porophilum* Lloyd & Underwood, Bull. Torr. Bot. Club **27**: 150. 1900, in part but not as to type specimen. *L. lucidulum*, var. *porophilum* Clute, The Fern Allies p. 111. 1905, in part; Gray's Manual edition 7: 55. 1908, in part.

In the east and probably as far southwest as eastern Ohio or Kentucky *L. Selago*, var. *patens* appears as an ecological form found growing in milder conditions at lower altitudes than the type or in mesophytic habitats. In Wisconsin, Indiana and part of Ohio there seems to be another factor that determines the range of this plant. That is Pleistocene isolation. In Wisconsin this plant is restricted almost entirely to the Driftless Area and its border. One exception to this range was recorded by the writer in 1930¹ but re-examination of this specimen shows it to be *L. lucidulum*, var. *occidentale*. However, in 1931 F. H. Knowlton and A. M. Fuller collected one plant of the variety *patens* growing back of a sand bar on Lake Superior at Cornucopia, Bayfield County, Wisconsin. This plant apparently developed from a water-, ice- or wind-carried gemma, the source of which might have been Isle Royale, since that is the closest known station. According to Mr. Fuller of the Milwaukee Public Museum there are other plant affinities at this point in Wisconsin with Isle Royale.

The isolated and marginal distribution of *L. Selago*, var. *patens* to the Driftless Area in Wisconsin is interesting. No station for this plant is known from the interior of that area though there are plenty of suitable habitats. Outside of the Driftless Area there are also suitable habitats but no plant of this species has been discovered except at Cornucopia as noted above. The distribution is very suggestive of the isolation of this subarctic and arctic species probably during the third substage of the Wisconsin glaciation.² It may also suggest

¹ Wilson, L. R. Lycopodiaceae and Selaginellaceae of Wisconsin. Trans. Wis. Acad. Sci., Arts & Lett. **25**: 170 & 172. 1930.

² Leverett, Frank. Moraines and shore lines of the Lake Superior basin. U. S. Geol. Surv. Prof. Paper 154-A p. 19. 1929.

that glacial climate was confined very largely to the border of the Driftless Area and milder conditions were prevailing in the interior of that area where plants of warmer climates could persist. Dr. N. C. Fassett has recorded numerous plants from the Driftless Area of Wisconsin which might have persisted there during the Pleistocene with *L. Selago*.³ This also seems probable, since the Driftless Area was never at any one time completely surrounded by ice.⁴ In Indiana the same relation to glacial boundaries is apparent from specimens in the herbarium of C. C. Deam. All recorded stations are south of the drift of the first substage of the Wisconsin glaciation. In Ohio the same conditions appear but are not as well understood. It may be that in that state several other factors have had much to do with the distribution of this species.

There is some conflict in statements as to the type of rock with which this variety is associated. In Gray's Manual the habitat is given as cool calcareous cliffs. Lloyd and Underwood in their description of *L. porophilum* (*L. Selago*, var. *patens*) state that it occurs on sandstone. In Indiana C. C. Deam has collected it on a limestone cliff. In Wisconsin the writer has tested the hydrogen ion concentration of the soil associated with this form at one station and found it to be approximately 6.3. This is a slightly acid soil but a type that could easily result from the leaching of soil on limestone, so it appears that the conflicting habitats recorded in literature cannot be considered too seriously.

In September of 1930 and 1931 plants and gemmae of both *L. lucidulum* and *L. Selago*, var. *patens* were placed in the greenhouse under various controlled conditions to have them closer at hand for study. The plants of both species produced new leaves which were characteristic of their respective species. The gemmae of *L. lucidulum* began to grow after seven months and those of *L. Selago*, var. *patens* began a month later. The gemmae that were planted in September, 1931, began growing at the end of two weeks and the roots of both species were covered with a plumose covering of fungus which may have been responsible for the early growth. The development in *L. lucidulum* differs from that of *L. Selago*, var. *patens* in that the shoot is usually about 5 mm. long before two small leaves become distinct.

³ Fassett, N. C. Notes from the Herbarium of the University of Wisconsin. RHODORA 33: 224-228. 1931.

⁴ Thwaites, F. T. The Driftless Area. Outline of Glacial Geology. Dept. of Geol. Univ. of Wis. p. 148. 1927.

Those following the first two are markedly serrate. In the latter species, leaves are present from the earliest development of the shoot and are entire like those of the mature plant. These characters were checked in the field and in general bore out the laboratory observations. *L. Selago*, var. *patens* always produced its first leaves as described but when *L. lucidulum* was found in exceedingly dry places the shoot was shorter than observed elsewhere. In the two species studied the plants from gemmae could always be distinguished from one another by the serrate or oblanceolate leaves of *L. lucidulum*.

The writer wishes to express his appreciation to Mr. Percy Wilson of the New York Botanical Garden to Mr. C. A. Weatherby of the Gray Herbarium, to Director S. C. Simms of the Field Museum of Natural History, to Mr. H. H. Smith of the Milwaukee Public Museum, to Dr. J. H. Schaffner of the Ohio State University and to Mr. C. C. Deam of Bluffton, Indiana, for the use of specimens and to Dr. N. C. Fassett and Mr. F. T. Thwaites for their helpful criticisms.

KEY TO LYCOPodium SELAGO, *L. LUCIDULUM* AND THEIR VARIETIES

- A. Leaves linear-attenuate to lanceolate, entire; spores 32 to 36 μ in diameter, with papillation uniform in size and distribution. . . . B.
- B. Leaves appressed. . . . C.
- C. Leaves not crowded, ascending. . . . *L. Selago*.
- C. Leaves crowded, much appressed. . . . *L. Selago*, var. *appressum*.
- B. Leaves spreading, often reflexed. . . . *L. Selago*, var. *patens*.
- A. Leaves oblanceolate, widest near or above the middle, serrate or entire; spores 20 to 26 μ in diameter, with papillation irregular in size and distribution. . . . D.
- D. Leaves serrate. . . . *L. lucidulum*.
- D. Leaves entire or slightly serrate. . . . *L. lucidulum*, var. *occidentale*.

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THE STATUS OF TWO INTRODUCTIONS BY MINOT PRATT AT CONCORD, MASSACHUSETTS: CAMPTOSORUS RHIZOPHYLLUS AND HELENIMUM AUTUMNALE.—Among the botanical papers of the late Walter Deane is a hectograph copy in longhand of a list of "Plants Introduced about Concord, Mass., by the late Minot Pratt," dated March 25, 1898, and probably compiled from Dame & Collins' Flora of Middlesex County. It is in the nature of a circular to members of the New England Botanical Club requesting information concerning the status of any of the



Wilson, L. R. 1932. "The identity of *Lycopodium porophilum*." *Rhodora* 34, 169–172.

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